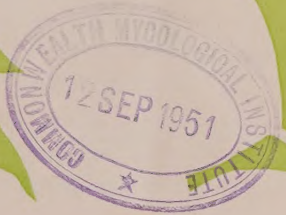
SPECIAL CIRC. NO. 11 - N. CAROLINA

CONTROL....

Stem Anthracnose

of lima beans

D. E. Ellis



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Control Stem Anthracnose Of Lima Beans

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Stem anthracnose[2] is one of the more common and destructive diseases affecting lima beans in North Carolina. The disease causes the red splotches so often seen on lima bean pods and also attacks the leaves and stems. The widespread occurrence of stem anthracnose is one of the main reasons why limas produce so poorly in home gardens, and it frequently causes severe losses in commercial plantings.

Results of recent research show that the disease can be effectively controlled under North Carolina conditions. Studies begun in 1946 have led to a better understanding of how this fungus disease behaves and made possible the development of practical methods of combating it.[3]

THE DISEASE

A Description of Symptoms

The most striking symptom of stem anthracnose is a brick-red discoloration of the pod (Figure 1). These discolored spots or splotches are first seen as tiny reddish dots, just visible to the naked eye and may start when the pod is just beginning to form. In fact, the flower stalks and blossoms are also frequently infected. Many diseased pods are killed before they reach full size. Others which reach full size, are not edible because the beans inside are discolored and rotted.

If infection is delayed until the beans are nearly full size, they may not be seriously damaged, but market quality is reduced since the red splotches make them unsightly. The disease continues to develop on the pods after harvest, and serious losses can occur during transit and storage.

The stem anthracnose fungus also affects the leaves (Figure 1) and stems of the lima bean plant. Many diseased leaves are killed and fall to the ground. This weakens the plant so that it forms fewer pods. Plants may even be killed before reaching maturity as a result of severe defoliation and stem infections.

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[2] Caused by the fungus *Colletotrichum truncatum*.

[3] A detailed discussion of the major portion of this research work is given in N. C. Agr. Exp. Sta. Tech. Bull. 90. April, 1950.

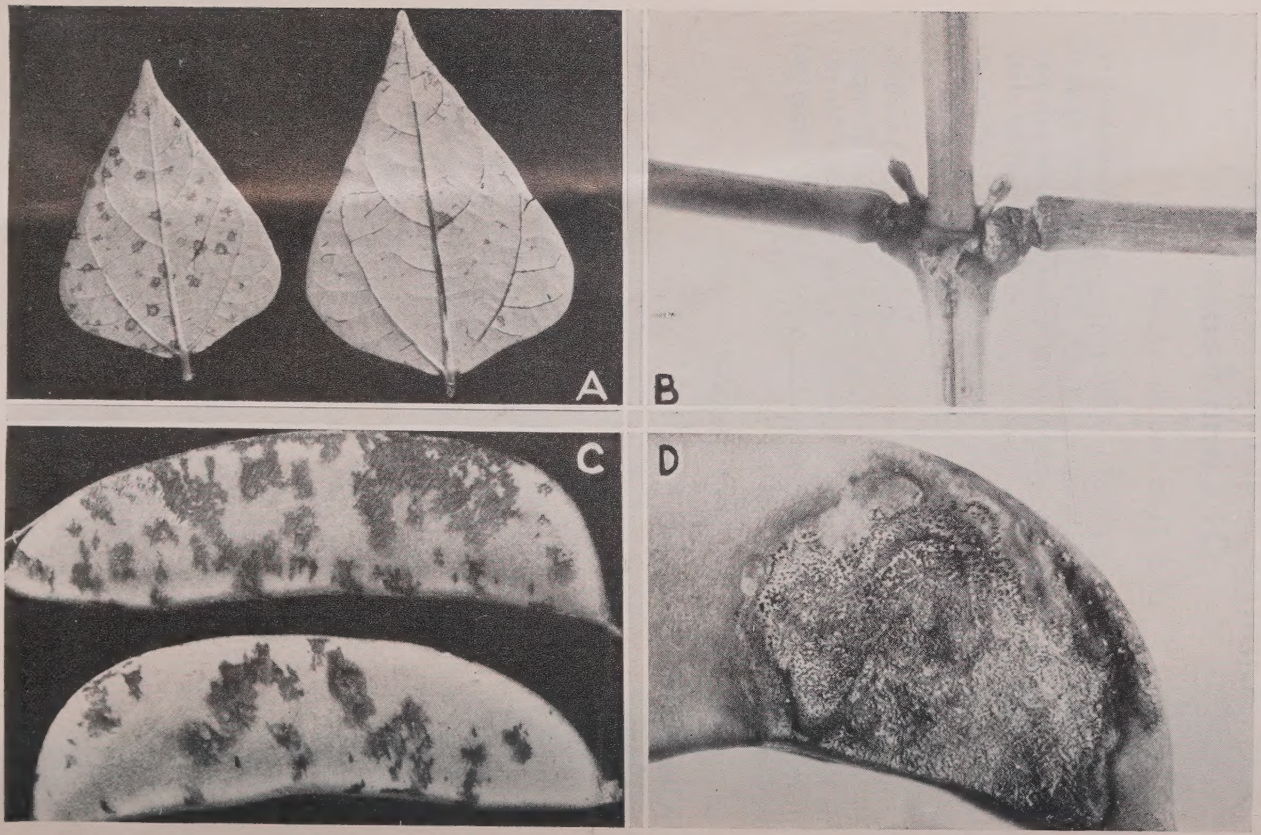

Fig. 1. Symptoms of stem anthracnose on leaflets (A), petioles (B), and pods (C & D).

Where the Disease is Found

Apparently stem anthracnose is, for the most part, a southern disease. It occurs in Alabama, Georgia, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Pennsylvania, Texas, Virginia, and Cuba. In North Carolina it causes serious losses throughout the Coastal Plain and Piedmont areas but does not appear to be an important problem in the Mountains.

Attacks Many Other Legumes

Tests have shown that the stem anthracnose fungus is capable of attacking many leguminous plants, though lima beans are most susceptible. The fungus was found to cause some infection of snap bean, alfalfa, birdsfoot trefoil, red clover, cowpea, soybean, hairy vetch, caley pea, and sweet pea. It did not attack crimson clover, sub clover, sweetclover, or peanut.

It was found on all of the common commercial varieties of lima beans. Tests in 1947 and 1948 with ten commercial bush lima bean varieties and six varieties of pole limas showed that all were susceptible. One variety, Jackson Wonder, was not as seriously affected as the others early in the season, but by the end of the season it was severely diseased. Of some 40 U.S.D.A. lima bean breeding lines tested, all were found to be quite susceptible except No. 4865 (Peerless) which showed some resistance. The search for lines resistant to the disease continues.

How the Disease Spreads and Overwinters

Since the stem anthracnose fungus is carried in the seed, this is one of the chief means by which it is spread. Many home gardeners save seed—one reason why the disease is so common in garden plantings. When diseased seeds are planted, the stems and leaves of the young seedlings are infected very early. The tiny spores (seed-like bodies) of the fungus are produced by the thousands on these young infections and serve to spread the disease to new leaves. The spores also can be carried from diseased to healthy plants by blowing rains, insects, and by cultivation and harvesting operations.

When the spores germinate (sprout) on the leaf, pod, or stem surface they send out tiny fungus threads which enter the plant. Once inside they continue to grow and spread in the plant tissues taking up food and killing the plant cells. After a few days the fungus breaks through to the surface again and produces more spores.

The fungus lives over the winter on old infected lima bean stems, leaves, and pods which remain on the surface of the soil.

From these it spreads to the new crop, even when disease-free seeds are planted. However, this danger can be largely eliminated by plowing under the old infected plants in the fall so that they can decay before spring.

Thrives in Hot, Moist Weather

The disease is favored by relatively high temperatures. In the laboratory the fungus grew best at about 80 to 85° F. It is worse in the field during the hot summer months than in the spring or fall. This may also explain why stem anthracnose is not a serious problem in the mountain area where the weather is cooler.

Spread of the disease is also favored by moist conditions such as are brought on by frequent rains and heavy dews. Spores can live for only a few hours on the surface of leaves exposed to direct sunlight.

HOW TO CONTROL STEM ANTHRACNOSE

Use Disease-Free Seed

One of the important means of combating stem anthracnose is to plant disease-free seed. This means that it is unwise to save home-grown seed for planting. Observations indicate that lima bean seed produced anywhere in the Piedmont or Coastal Plains areas is liable to carry some infection. Some seed lots have been found very heavily infected. Stem anthracnose has not been reported from the arid regions of the west, suggesting that only western grown seed should be planted.

Practice Fall Plowing, Crop Rotation

Wherever possible lima beans should not be grown on the same land more often than once every two or three years. Other susceptible legumes such as snap bean, soybean, and cowpea should be avoided in the rotation. If it is necessary to plant lima beans on the same land in two successive years, the land should be plowed deeply early in the fall. This allows the old infected plants to decay and reduces or prevents carry over of the fungus.

Sprays and Dusts Prove Effective

Stem anthracnose can be controlled by spraying or dusting the plants with a protective fungicide. Results of experiments over a four-year period, 1947-1950, demonstrated this conclusively as illustrated in Figures 2, 3 and 4 and Tables 1 and 2. Of the fungicides tried, zineb, sold under the trade names Dithane Z-78 and Parzate,[4] gave the most consistently beneficial results. Ziram (Zerlate)[4] also showed some promise, but was somewhat less ef-

[4] Dithane Z-78 and Parzate each contain 65 per cent zineb (zinc ethylene bisdithiocarbamate). Zerlate contains 76 per cent ziram (zinc dimethyl-dithiocarbamate). Phygon XL contains 50 per cent 2,3 dichloro 1, 4 naphthoquinone.

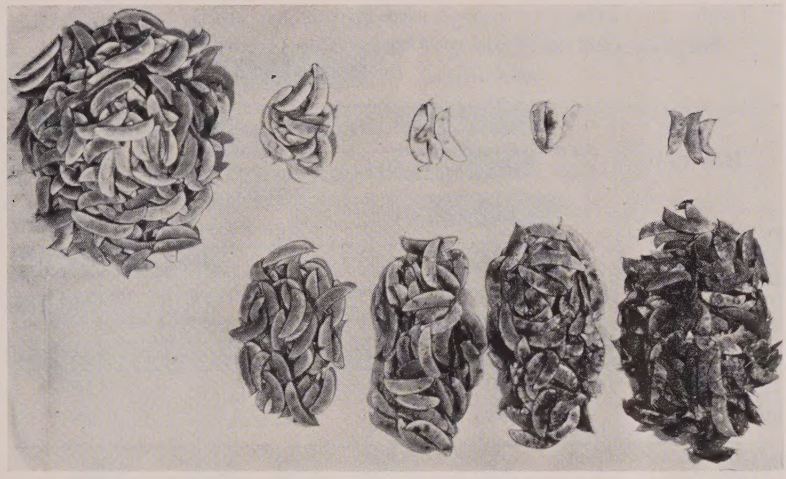

Fig. 2. The Lima beans harvested from sprayed (above) and non-sprayed (below) plots, graded according to severity of stem anthracnose. The large pile from the sprayed lot (above, left) is disease-free.

fective than zineb under severe disease conditions. Phygon XL[4] also gave very good control but caused considerable injury to lima bean plants and is not considered safe.

Fungicidal dusts were also tested but in general were not as effective as when used as sprays. This was especially true in 1947 and 1948 tests at the McCullers Branch Experiment Station. (See N. C. Agr. Exp. Sta. Tech. Bull. 90) and in 1950 at the Coastal Plains Vegetable Station, Faison, (Table 2). Dusts gave fair control at McCullers in 1950 (Table 2) where the disease was not as severe as in other tests.

In 1949, Dithane Z-78, Parzate and Phygon-XL sprays each were applied at 5-, 10-, and 15-day intervals, starting after the disease had gained considerable headway. The results, given in Table 1, clearly show that sprays should be applied about every five to seven days for best control.

Most fungicide tests were made with the common Henderson Bush variety of lima beans. While similar results might be expected with other varieties, only a few have been tested to date. In one 1949 test the varieties Fordhook 242 and Jackson Wonder were sprayed at five-day intervals with Dithane Z-78, Parzate, or Phygon-XL. For both varieties the best yields were obtained

Table 1. Effect of Fungicidal Sprays on Stem Anthracnose Severity and on Yield of Marketable Green Lima Beans, McCullers, N. C., 1949.

Material	Application Schedule (days between sprays)	Disease Severity (0=no disease 100=maximum severity)	Yield Marketable fruit (bu. per A.)
Dithane Z-78 (1½ lbs. per 100 gallons of water)	5	10	350
	10	15	240
	15	27	112
Parzate (1½ lbs. per 100 gallons of water)	5	12	390
	10	20	148
	15	32	90
Phygon-XL (1½ lbs. per 100 gallons of water)	5	15	205
	10	23	121
	15	29	134
Check	—	61	106

Table 2. Effect of Fungicidal Sprays and Dusts on Yields of Lima Beans Affected With Stem Anthracnose, Faison and McCullers, N. C., 1950

Material[1]	Yield Marketable Fruit (Bu. per A.)	
	Faison	McCullers
Parzate Spray	132	162
Dithane Z-78 Spray	130	156
Zerlate Spray	114	160
Check (Non-treated)	61	129
Parzate Dust	93	135
Dithane Z-78 Dust	90	152
Zerlate Dust	92	139

[1] The sprays were all prepared at a concentration of 1½ pounds of the commercial fungicide per 100 gallons of water. All dusts contained 8 per cent of the commercial fungicide with pyrophyllite used as the diluent.

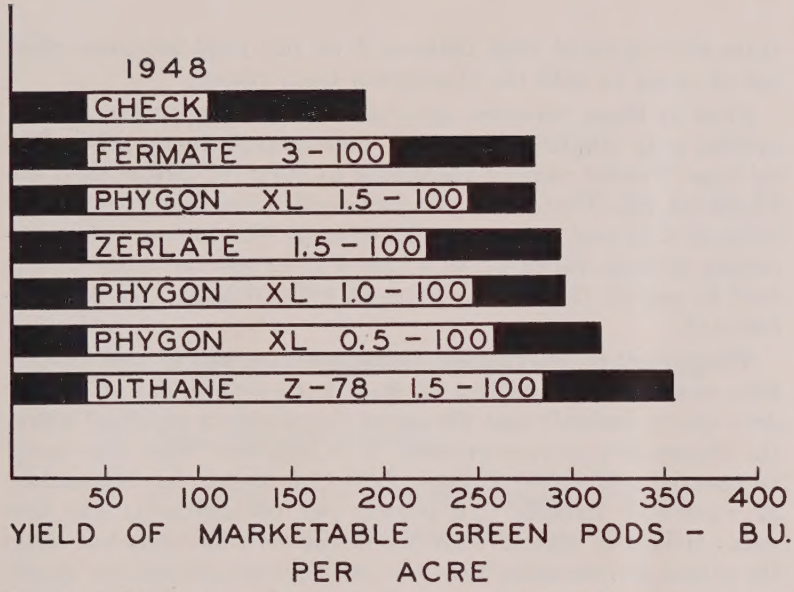
1948
CHECK
FERMATE 3 - 100
PHYGON XL 1.5 - 100
ZERLATE 1.5 - 100
PHYGON XL 1.0 - 100
PHYGON XL 0.5 - 100
DITHANE Z-78 1.5 - 100
50 100 150 200 250 300 350 400
YIELD OF MARKETABLE GREEN PODS - BU. PER ACRE

Fig. 3. This is how fungicides increased the yield of lima beans at McCullers Branch Station in 1948.

Fig. 4. Stem anthracnose has caused the loss of many leaves from plants in unsprayed rows (right). Compare with treated row (left).

from plots sprayed with Dithane Z-78, but yield increases were not as great as with the Henderson Bush variety.

Plots of these varieties sprayed with Parzate or Phygon-XL yielded only slightly more than non-sprayed check plots. The Jackson Wonder variety responded to spraying better than did Fordhook 242. There has been some indication that Parzate and Dithane Z-78 may cause a slight delay in blossoming and in the setting of pods. However, in a 1950 Faison test no injury of any kind to any of 16 varieties sprayed with Dithane Z-78 could be detected.

While further information is needed on spraying and dusting lima beans for the control of stem anthracnose, the results to date clearly indicate that the use of fungicides is practical where the disease is a serious problem. It is suggested that lima beans be sprayed with either Dithane Z-78 (1.5 pounds per 100 gallons of water) or Parzate (1.5 pounds per 100 gallons). The first spray should be applied when the disease is first noticed or when the plants are blooming the first time. Spray applications should be repeated every five to seven days until harvest. Sprays can be applied to small garden plantings with knapsack or pressure tank sprayers or to larger acreages with row crop sprayers.

It is essential to thoroughly cover all plant parts, including both upper and lower leaf surfaces. This requires equipment that develops a pressure of 100 to 200 pounds and produces a good "fog" of the spray. It requires at least 100 gallons of spray to cover adequately an acre of lima beans.

Where spraying is not practical, dust containing 8 per cent of either Dithane Z-78 or Parzate is suggested. However, better control can be expected from sprays. Dusts should be applied with rotary hand or row crop dusters that give thorough coverage and applications should be repeated every four to five days.

SUMMARY OF CONTROL RECOMMENDATIONS

1. Plant disease-free seed.

2. If possible, do not plant lima beans in the same soil more often than once every two or three years. Avoid other susceptible legumes in the rotation (See Page 5).

3. If necessary to plant in the same soil in successive years, plow under old plants early in fall.

4. Spray with Dithane Z-78 (1.5 pounds per 100 gallons of water) or Parzate (1.5 pounds per 100 gallons of water) starting when disease is first noticed or when plants are starting to blossom. Repeat at five- to seven-day intervals until harvest.

Agricultural Experiment Station

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